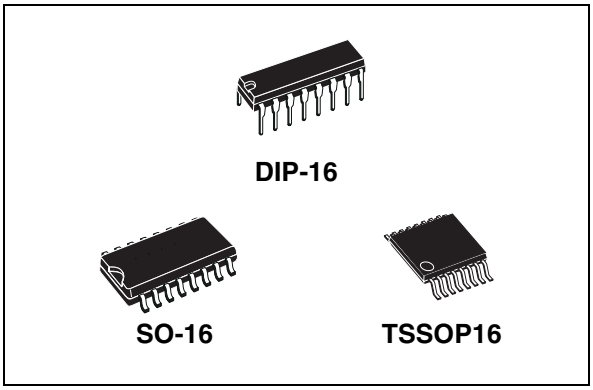
STPIC6D595

Power logic 8-bit shift register

Features

- Low $R_{DS(on)}$: 4 Ω typ
- Eight 100 mA DMOS outputs
- 250 mA current limit capability
- Devices are cascadable
- Low power consumption
- Footprint compatible with STPIC6C595



Description

This STPIC6D595 is a monolithic, medium-voltage, low current power 8-bit shift register designed for use in systems that require relatively moderate load power such as LEDs.

The device contains an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. Data transfers through both the shift and storage register clock (SRCK) and the register clock ($\overline{RCK}$), respectively. The device transfers data out the serial output (SER OUT) port on the rising edge of SRCK. The storage register transfers data to the output buffer when shift register clear ($\overline{CLR}$) is high. When $\overline{CLR}$ is low, the input shift register is cleared. When output enable ($\overline{G}$) is held high, all data in the output buffer is held low and all drain output are off. When G is held low, data from the storage register is transparent to the output buffer.

When data in the output buffers is low, the DMOS transistor outputs are off. When data is high, the DMOS transistor outputs have sink-current capability. The SER OUT allows for cascading of the data from the shift register to additional devices.

Output are low-side, open-drain DMOS transistors with output ratings of 20 V and 120 mA continuous sink-current capability. Each output provides a 250 mA maximum current limit at T_C = 25 °C. The current limit decreases as the junction temperature increases for additional device protection. The device also provides up to 2.0 kV of ESD protection when tested using the human-body model.

The STPIC6D595 is characterized for operation over the operating case temperature range of -40 °C to 125 °C.

Table 1. Device summary

Order codes	Package	Packaging
STPIC6D595MTR	SO-16 (Tape and reel)	2500 parts per reel
STPIC6D595TTR	TSSOP16 (Tape and reel)	2500 parts per reel
STPIC6D595B1R	DIP-16	25 parts per tube

Contents

1 Logic symbol and pin configuration

Figure 1. Pin configuration

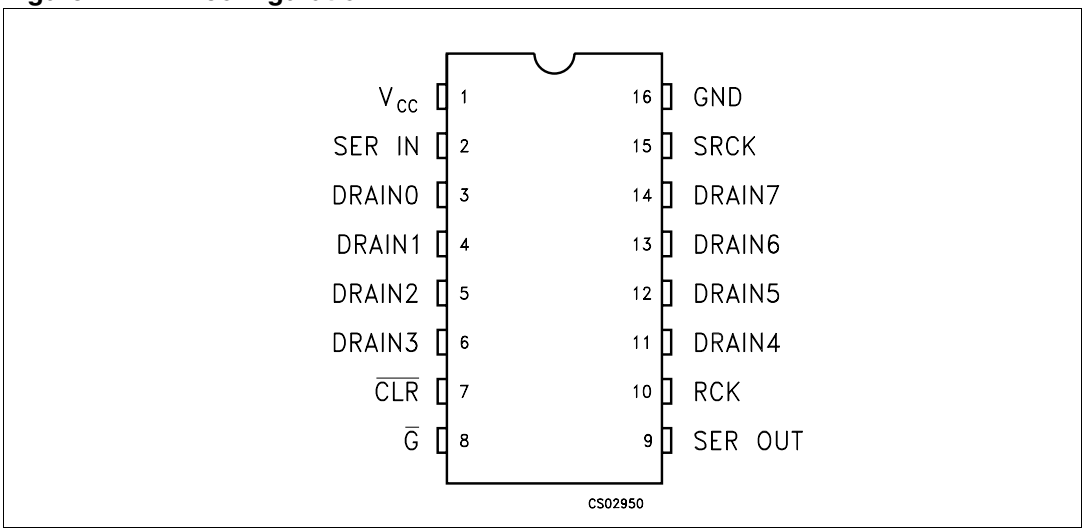
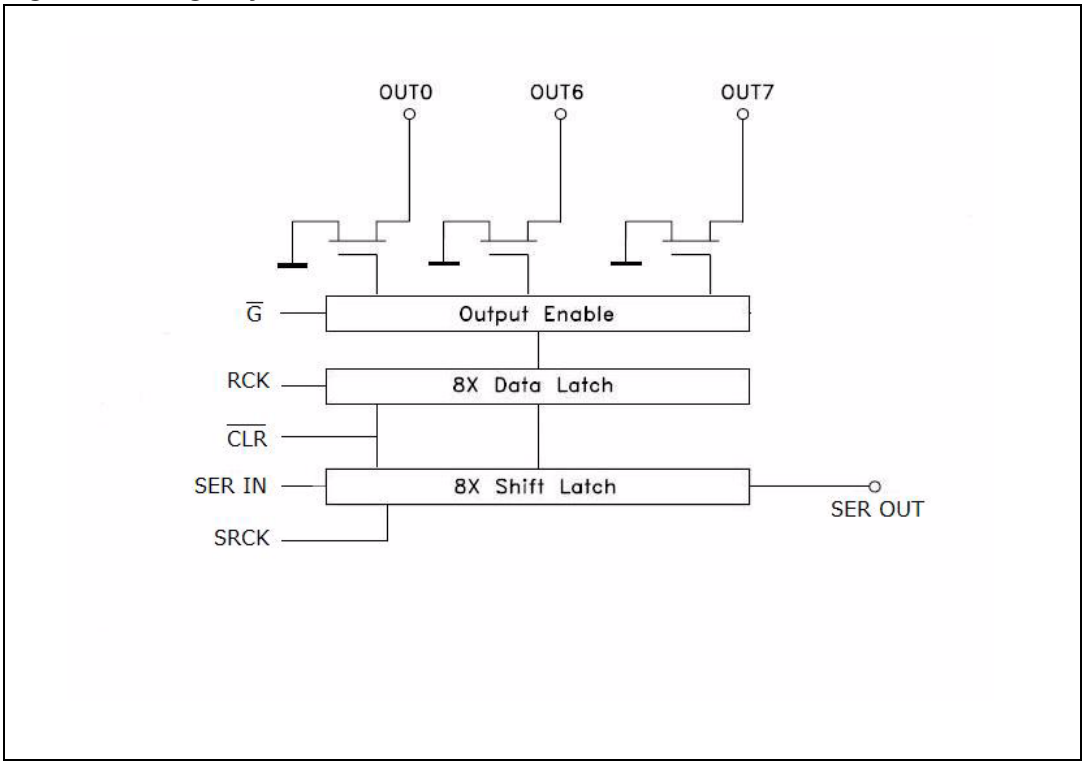


Figure 2. Logic symbol



2 Maximum rating

Stressing the device above the rating listed in the “absolute maximum ratings” table may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in the operating sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

2.1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Logic supply voltage (See *Note 1*)	7	V
V_I	Logic input voltage range	-0.3 to 7	V
V_{DS}	Power DMOS drain to source voltage (See *Note 2*)	20	V
I_D	Pulsed drain current, each output, all output ON (T_C = 25 °C)	250	mA
I_D	Continuous current, each output, all output ON (T_C = 25 °C)	100	mA
I_D	Peak drain current single output (T_C = 25 °C) (See *Note 3*)	250	mA
P_d	Continuous total dissipation ($T_C \leq 25$ °C)	1087	mW
P_d	Continuous total dissipation (T_C = 125 °C)	217	mW
T_J	Operating virtual junction temperature range	-40 to +150	°C
T_C	Operating case temperature range	-40 to +125	°C
T_{stg}	Storage temperature range	-65 to +150	°C
T_L	Lead temperature 1.6 mm (1/16 inch) from case for 10 seconds	260	°C

2.2 Thermal data

Table 3. Thermal data

Symbol	Parameter	Package	Values	Unit
$R_{th(JA)}$	Thermal resistance junction-ambient	DIP-16	85	°C/W
		SO-16	107	
		TSSOP16	143	

2.3 Recommended operating conditions

Table 4. Recommended operating conditions

Symbol	Parameter	Min	Max	Unit
V_{CC}	Logic supply voltage	4.5	5.5	V
V_{IH}	High level input voltage	$0.85V_{CC}$	V_{CC}	V
V_{IL}	Low level input voltage	0	$0.15V_{CC}$	V
I_{DP}	Pulse drain output current (T_C = 25 °C, V_{CC} = 5 V, all outputs ON) (see *Note 3*, *Note 4*)		250	mA
t_{su}	Set-up time, SER IN high before SRCK ↑ (see *Figure 4* and *Figure 8*)	10		ns
t_h	Hold time, SER IN high after SRCK ↑ (see *Figure 4*, *Figure 7*, *Figure 8*)	10		ns
t_W	Pulse duration (see *Figure 8*)	40		ns
T_C	Operating case temperature	-40	125	°C

3 Electrical characteristics

3.1 DC characteristics

V_{CC} = 5 V, T_C = 25 °C, unless otherwise specified.

Table 5. DC characteristics

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$V_{(BR)DSX}$	Drain-to-source breakdown voltage	I_D = 1 mA			20	V
V_{SD}	Source-to-drain diode forward voltage	I_F = 100 mA		0.85	1.2	V
V_{OH}	High level output voltage SER OUT	I_{OH} = -20 µA V_{CC} = 4.5 V	4.4	4.49		V
		I_{OH} = -4 mA V_{CC} = 4.5 V	4			V
V_{OL}	Low level output voltage SER OUT	I_{OH} = 20 µA V_{CC} = 4.5 V		1	100	mV
		I_{OH} = 4 mA V_{CC} = 4.5 V		145	300	mV
I_{IH}	High level input current	V_{CC} = 5.5 V V_I = V_{CC}		1	100	nA
I_{IL}	Low level input current	V_{CC} = 5.5 V V_I = 0		-1	-100	nA
I_{CC}	Logic supply current	V_{CC} = 5.5 V All outputs OFF or ON		23	40	µA
$I_{CC(FRQ)}$	Logic supply current at frequency	f_{SRCK} = 5 MHz C_L = 30 pF All outputs OFF (See *Figure 6*,(1))		70	250	µA
I_N	Nominal current	$V_{DS(on)}$ = 0.5 VI_N = I_D T_C = 85 °C (See *Note 4*, *Note 5*, *Note 6*) (1)		120	200	mA
I_{DSX}	Off-state drain current	V_{DS} = 20 V V_{CC} = 5.5 V or 0 V		0.02	1	µA
		V_{DS} = 20 V V_{CC} = 5.5 V or 0 V T_C = 125 °C		0.5	1	µA
$R_{DS(on)}$	Static drain source on state resistance (See *Note 4*, and *Note 5*)	I_D = 50 mA V_{CC} = 4.5 V		3.4	4	Ω
		I_D = 50 mA V_{CC} = 4.5 V T_C = 125 °C		4.8	6	Ω
		I_D = 100 mA V_{CC} = 4.5 V		3.5	6	Ω

1. Not tested, specified by design

3.2 Switching characteristics

V_{CC} = 5 V, T_C = 25 °C, unless otherwise specified.

Table 6. Switching characteristics

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
t_{PHL}	Propagation delay time, high to low level output from $\overline{G}$	C_L = 30 pF I_D = 75 mA (See *Figure 4*, *Figure 5*, *Figure 6*, *Figure 7*,)	-	19	30	ns
t_{PLH}	Propagation delay time, low to high level output from $\overline{G}$		-	46	70	ns
$t_{PHL-SDO}$	Propagation delay time, clock to SDO		-	19	25	ns
$t_{PLH-SDO}$	Propagation delay time, clock to SDO		-	46	60	ns
t_{PLH-R_O}	Propagation delay low to high level RCK to OUT		-	62	90	ns
t_{PHL-R_O}	Propagation delay high to low level RCK to OUT		-	13	18	ns
t_{PLH-S_SO}	Propagation delay low to high level SCK to SDO		-	14	20	ns
t_{PHL-S_SO}	Propagation delay high to low level SCK to SDO		-	14	20	ns
t_r	Rise time, drain output		-	20	30	ns
t_f	Fall time, drain output		-	15	20	ns

Note: 1 All voltage value are with respect to GND

2 Each power DMOS source is internally connected to GND

3 Pulse duration ≤ 100 µs and duty cycle ≤ 2%

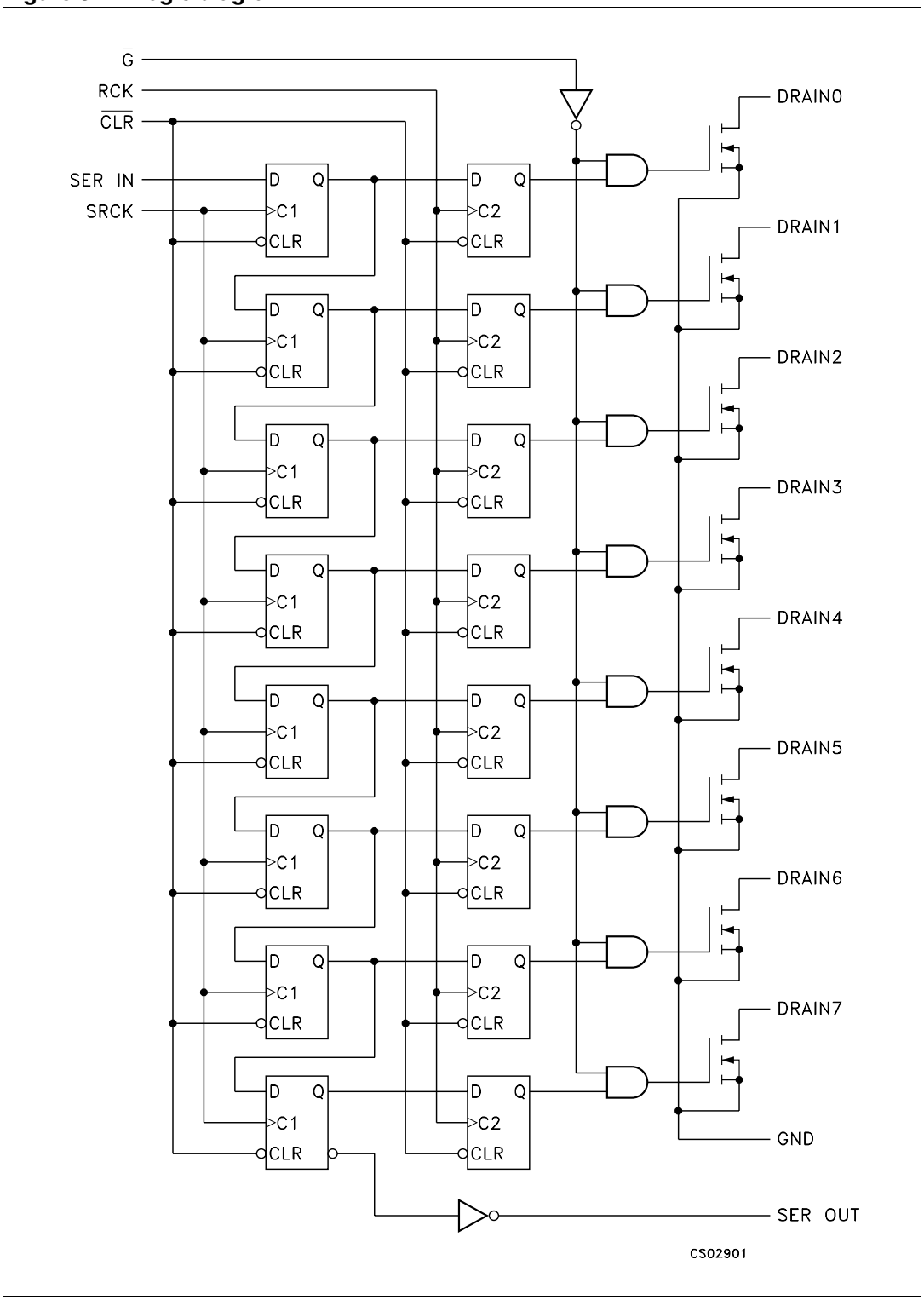
4 Technique should limit T_J - T_C to 10 °C maximum

5 These parameters are measured with voltage sensing contacts separate from the current-carrying contacts.

6 Nominal Current is defined for a consistent comparison between devices from different sources. It is the current that produces a voltage drop of 0.5 V at T_C = 85 °C.

4 Logic diagram

Figure 3. Logic diagram



5 Typical operating circuit

Figure 4. Typical operation mode test circuits

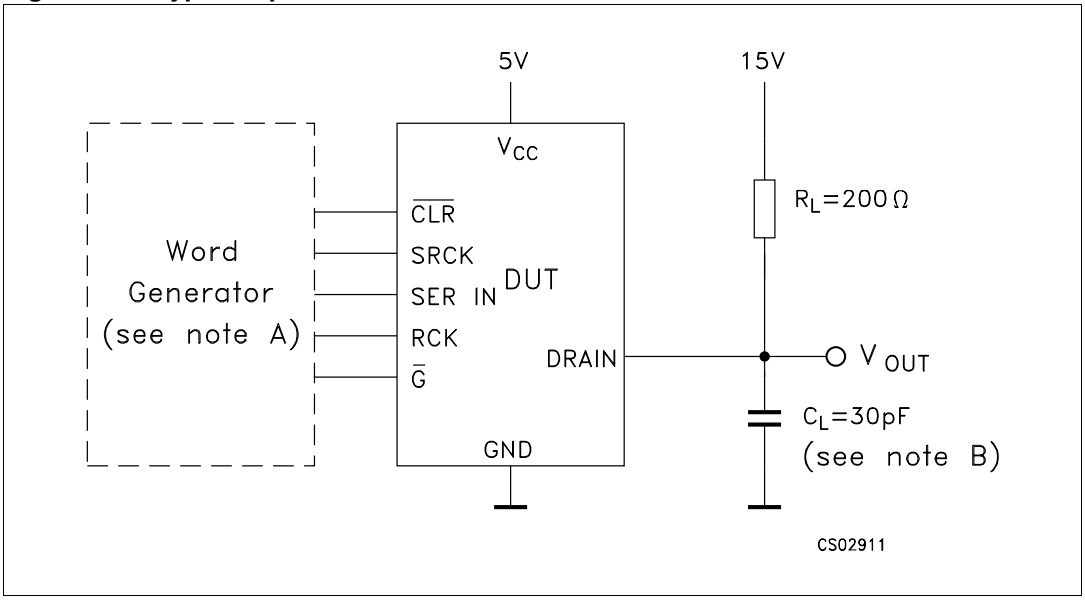
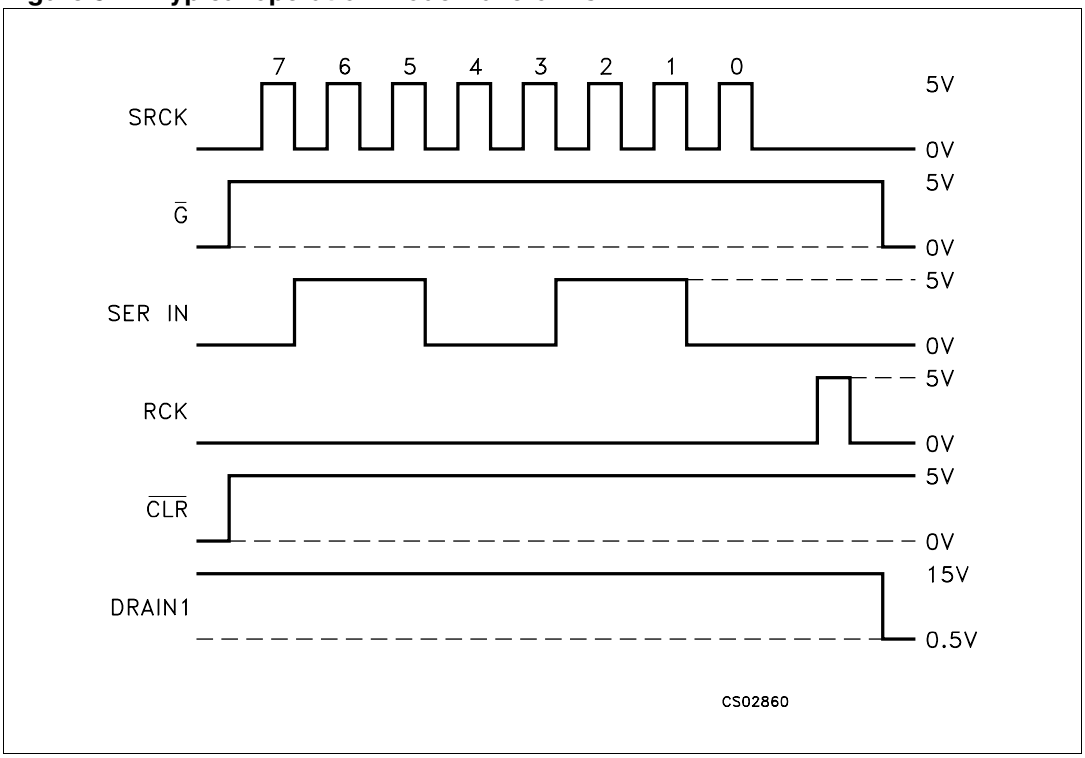


Figure 5. Typical operation mode waveforms



Note: 1 A) The word generator has the following characteristics: $t_r \leq 10$ ns, $t_f \leq 10$ ns, $t_W = 300$ ns, pulse repetition rate (PRR) = 5 kHz, $Z_O = 50\ \Omega$

2 B) C_L includes probe and jig capacitance.

Figure 6. Typical operation mode test circuits

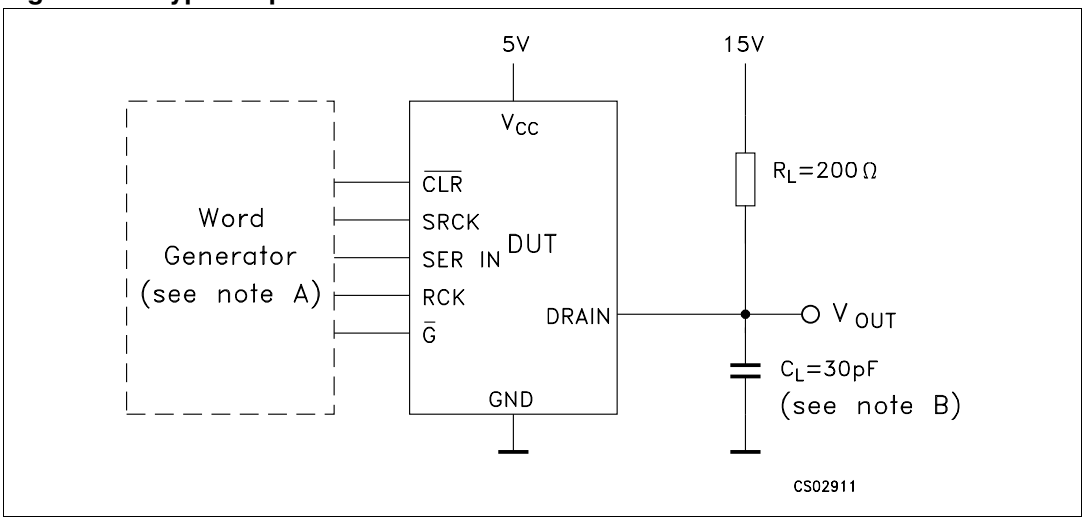


Figure 7. Switching time waveform

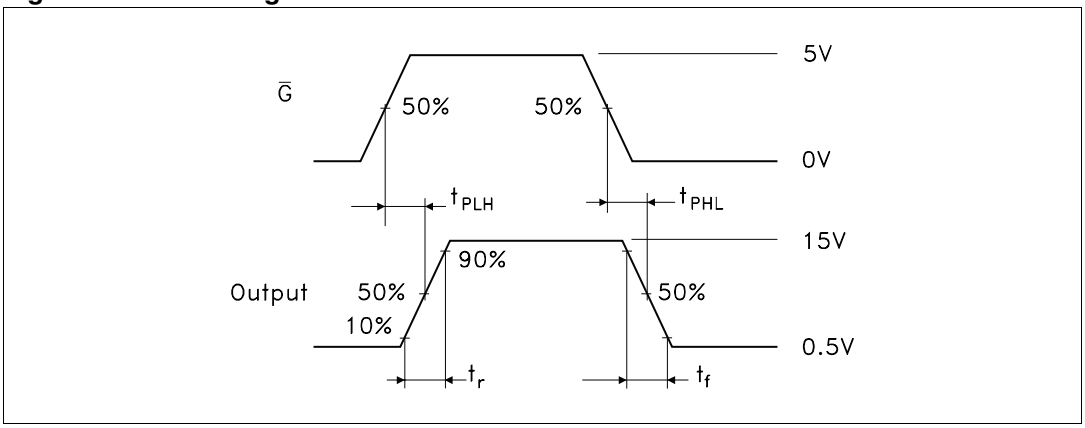
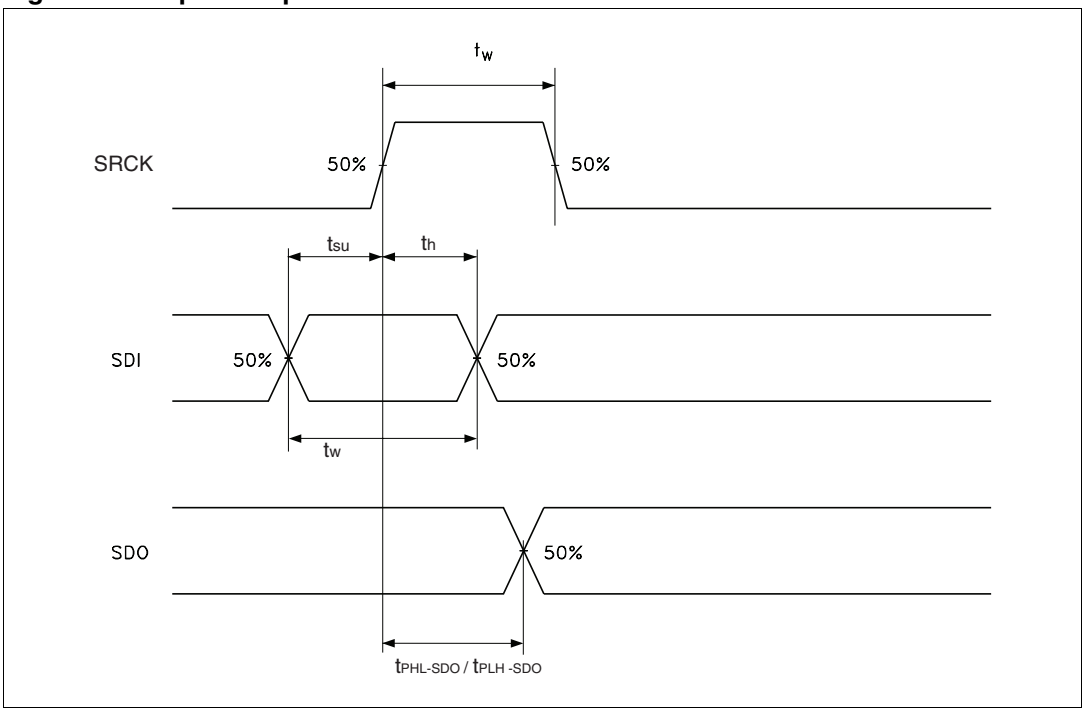


Figure 8. Input setup and hold waveform



Note: 1 A) The word generator has the following characteristics: $t_r \leq 10$ ns, $t_f \leq 10$ ns, $t_W = 300$ ns, pulse repetition rate (PRR) = 5 kHz, $Z_O = 50\ \Omega$

2 B) C_L includes probe and jig capacitance.

Figure 9. Input equivalent circuit

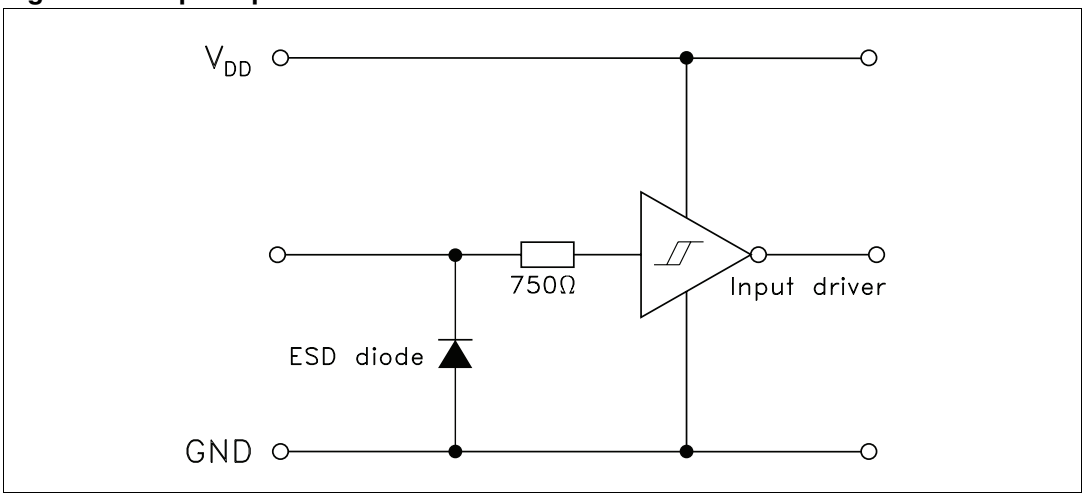
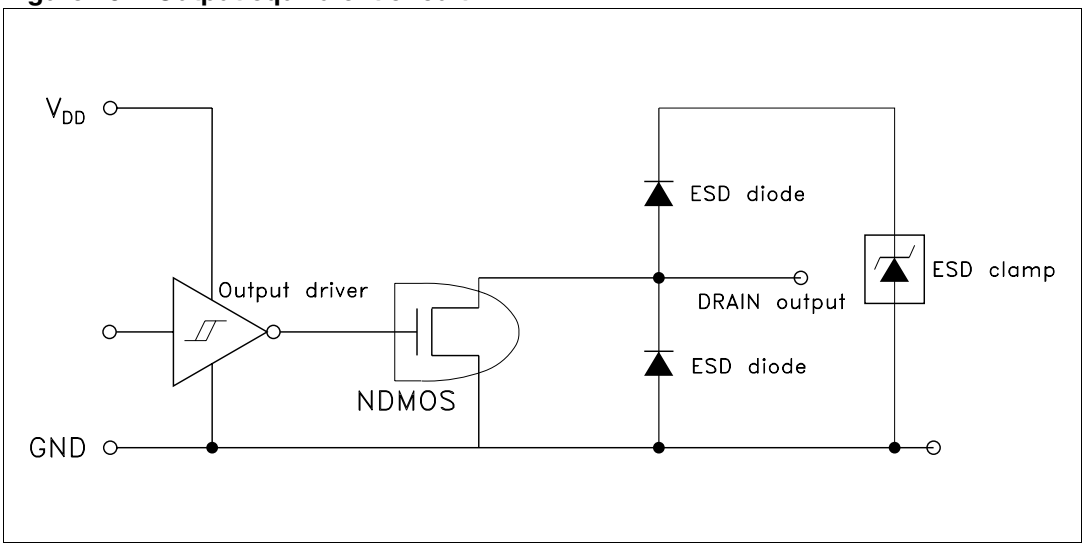


Figure 10. Output equivalent circuit



6 Typical performance and characteristics

Unless otherwise specified T_J = 25 °C

Figure 11. Static drain-source on-state resistance vs logic supply voltage

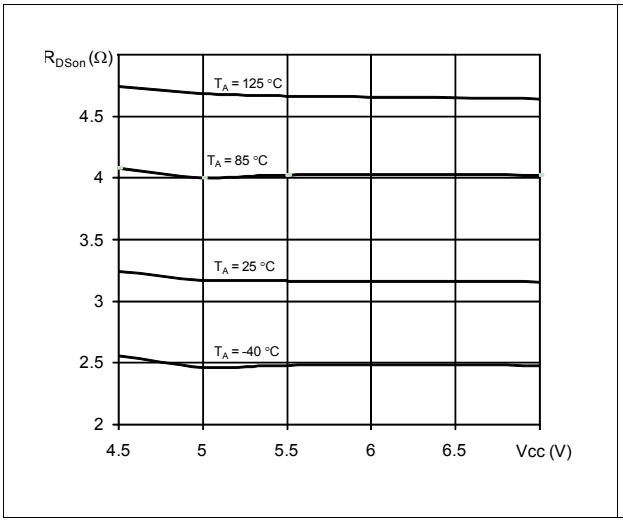


Figure 12. Supply current vs frequency

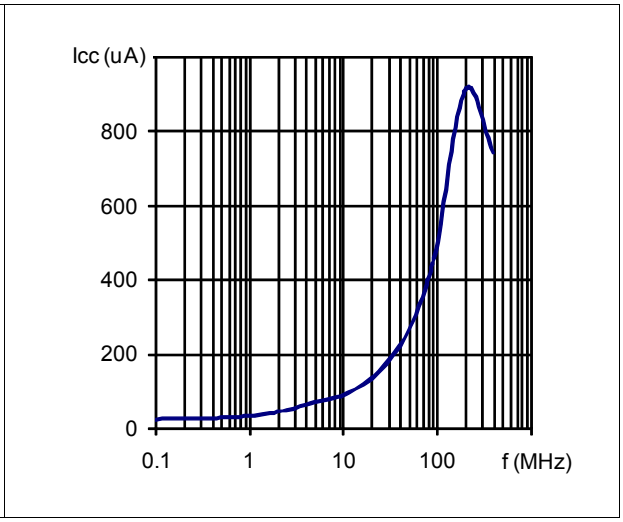


Figure 13. Supply current vs supply voltage

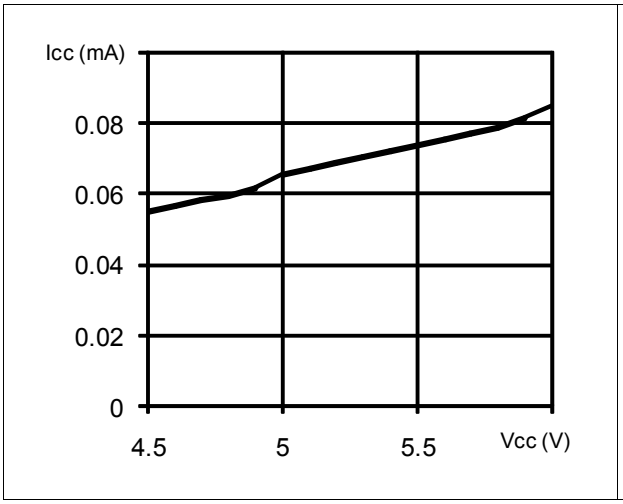
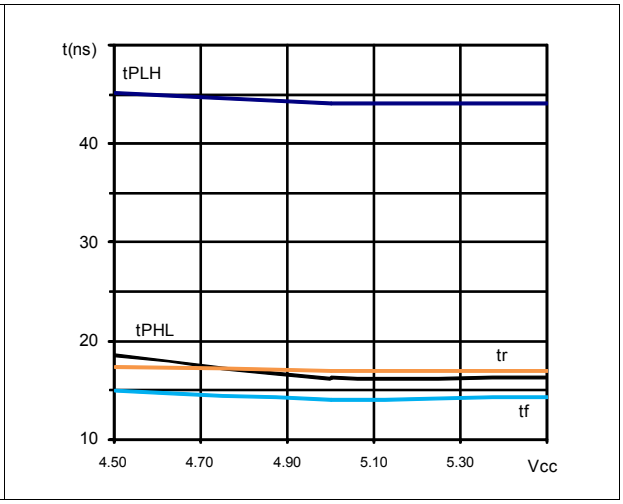


Figure 14. Switching time vs case temperature

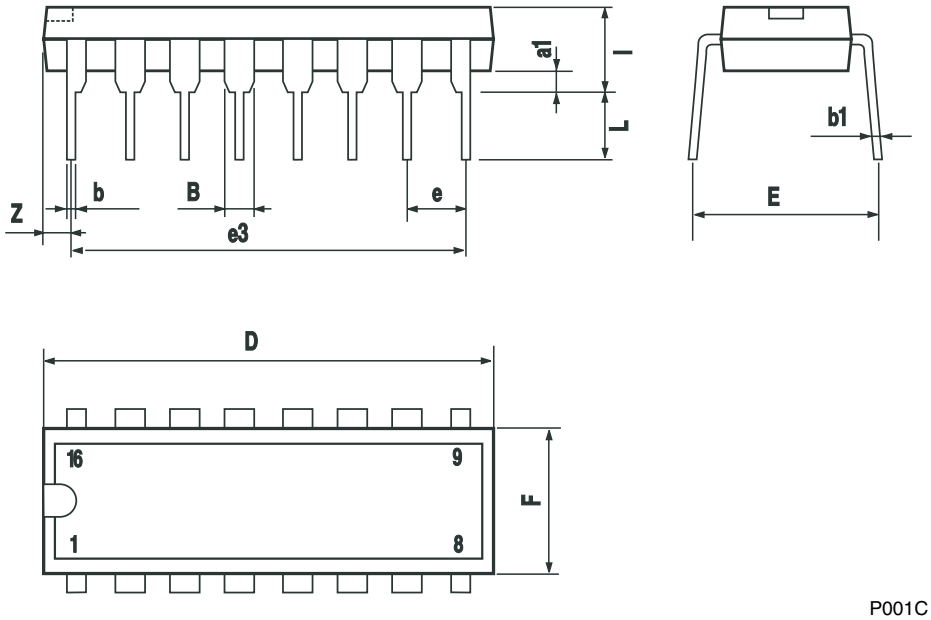


7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

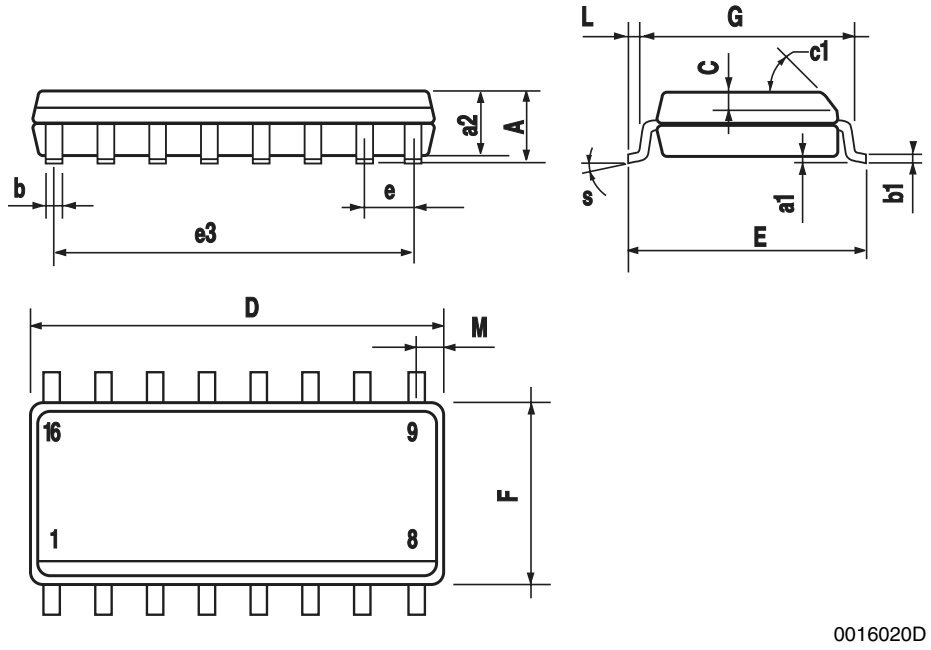
Plastic DIP-16 (0.25) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050



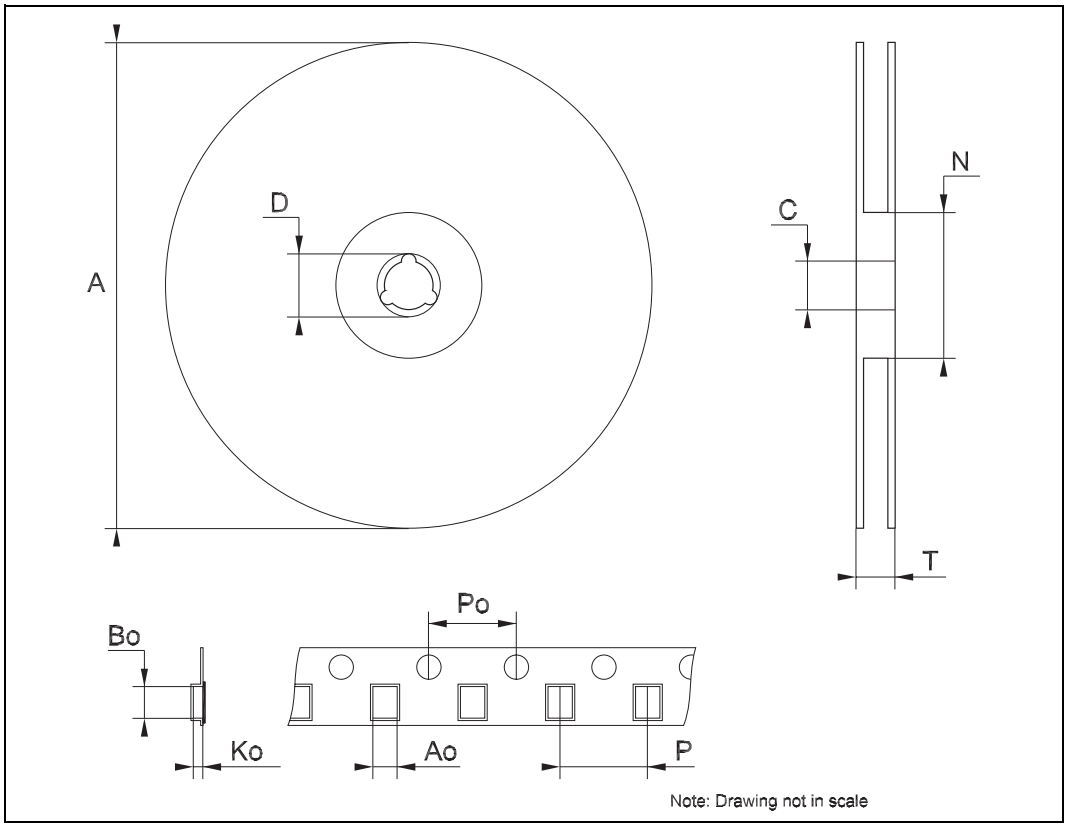
SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.25	0.004		0.010
a2			1.64			0.063
b	0.35		0.46	0.013		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.019	
c1	45° (typ.)					
D	9.8		10	0.385		0.393
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.149		0.157
G	4.6		5.3	0.181		0.208
L	0.5		1.27	0.019		0.050
M			0.62			0.024
S	8° (max.)					



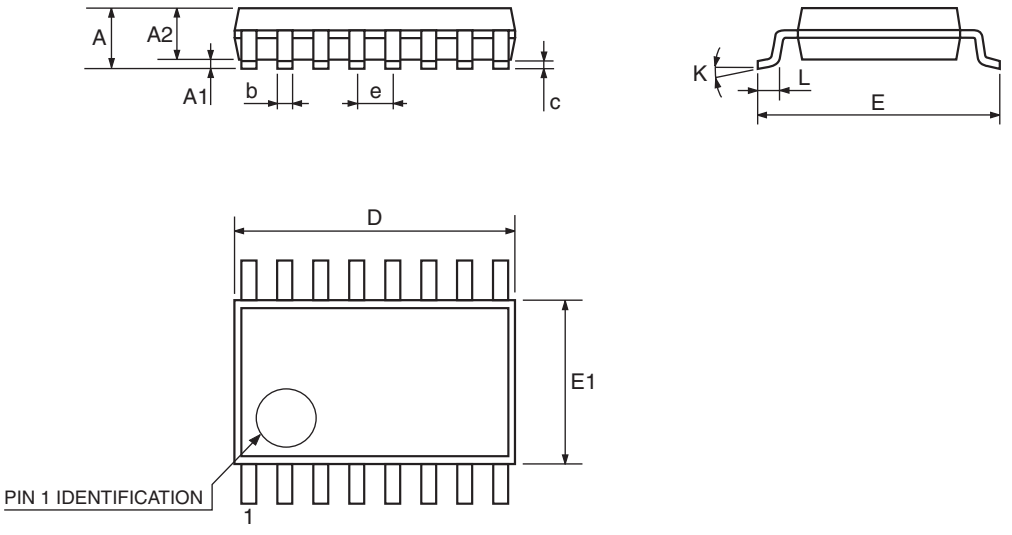
Tape & Reel SO-16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.45		6.65	0.254		0.262
Bo	10.3		10.5	0.406		0.414
Ko	2.1		2.3	0.082		0.090
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



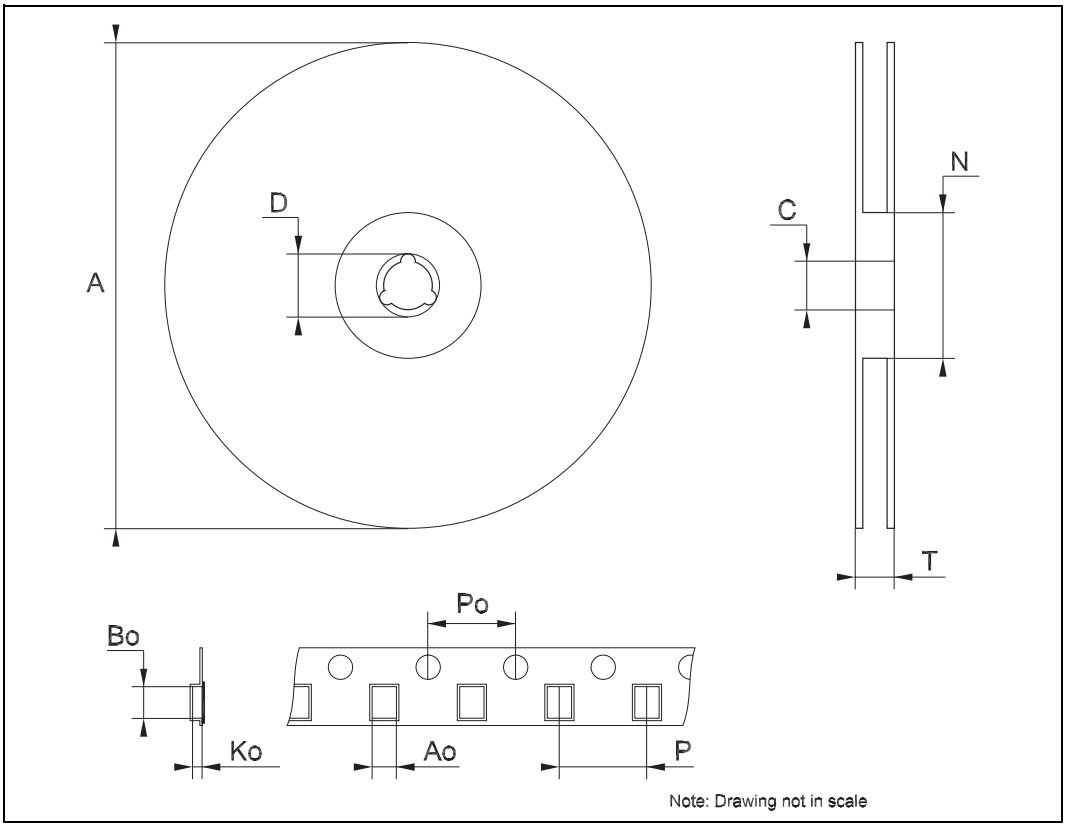
TSSOP16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0079
D	4.9	5	5.1	0.193	0.197	0.201
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030



Tape & Reel TSSOP16 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			330			12.992
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.7		6.9	0.264		0.272
Bo	5.3		5.5	0.209		0.217
Ko	1.6		1.8	0.063		0.071
Po	3.9		4.1	0.153		0.161
P	7.9		8.1	0.311		0.319



8 Revision history

Table 7. Document revision history

Date	Revision	Changes
20-Jun-2007	1	First release
06-Sep-2007	2	Change from Preliminary to final version
17-Nov-2009	3	Updated: *Table 2*, *Table 3*, *Table 5*, *Table 6*, *Table 6*, *Figure 1*, *Figure 7*, *Figure 8* and *Figure 9* Added: *Figure 2*, *Figure 11*, *Figure 12*, *Figure 13* and *Figure 14*

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